Resource Conservation in Arizona

United States Department of Agriculture

Prepared by Soil Conservation Service

February 1982

ARIZONA - AN OVERVIEW

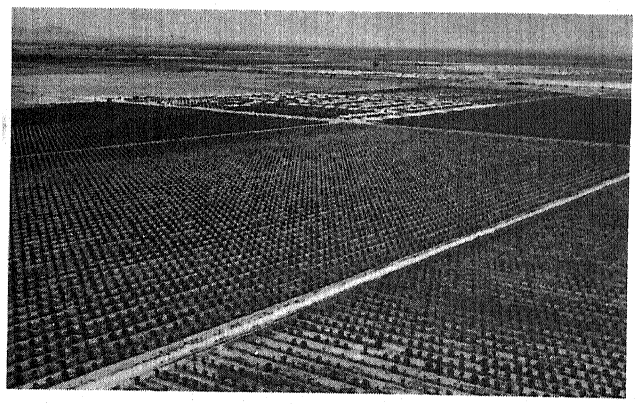
Arizona includes 72.7 million acres. This places it as the sixth largest state in the nation. County population densities per square mile vary from 3.7 in Mohave County to 158.5 in Maricopa County where the Phoenix-Sun City-Mesa metropolitan area is located. There are 22 Indian reservations.

The climate varies from cool and semi-arid to hot and arid. It is not unusual on some spring or fall days for Arizona to have the hottest and coldest recorded temperatures in the United States. Individuals have been known to snow ski and water ski on the same day after a drive of only 135 miles. Average yearly precipitation varies from less then 3 inches near Yuma to more than 35 inches on the San Francisco Peaks and in the White Mountains.

Arizona contains parts of the Sonoran, Chihuahuan and Mohave deserts. Each of these has its own unique vegetation. We also have the world's largest ponderosa pine forest along the Mogollon Rim. These extremes result from the difference between the summer and winter climatic patterns and the elevation variations from 138 feet near Yuma to over 12,000 feet above sea level on the San Francisco Peaks.

Manufacturing, tourism and travel, mining, and agriculture are the four principal industries. In 1979, they generated an estimated $13 billion. We are the largest copper producing state in the U.S. with 65.7% of the total production.

The major crop production comes from about 1.4 million acres of irrigated land. There are a few hundred acres of dryland crops produced in the northeast part of Arizona. These lands yield a large variety of crops, but cotton is king with as much as 45% of the cropland devoted to this crop. Arizona ranked third in cotton production in 1980. Cattle graze approximately 45 million acres of rangeland in the state every year. When good winter or spring moisture falls, another 12 million acres in the arid southwest part may also be grazed.



CONSERVATION DISTRICTS

Arizona's legislature passed the Arizona Soil Conservation District Law in 1941. At that time, the law allowed districts to form only in irrigated or dryland farming areas. In 1954, the law was amended to include rangelands.

As a result, 53 Soil Conservation Districts have been organized in Arizona. By 1970, these districts had consolidated into just 31 districts covering about 83% of the state. In 1971, the district law was amended to change the names from Soil Conservation to Natural Resource Conservation Districts (NRCD).

In 1981, the Little Colorado River Soil and Water Conservation District (SWCD) was formed. This district is located on the Navajo Indian Reservation and is the first to be formed under Tribal Law instead of the State District Law.

The responsibility for administering Arizona's Natural Resource Conservation District Law is assigned to the Arizona State Land Department. The State Land Commissioner also has the titles of State Natural Resource Conservation Commissioner and State Forester. The Arizona Association of Conservation Districts, a voluntary association, meets with personnel of the Land Department but is not recognized as an official commission to advise the State Land Commissioner.

The NRCD's and the Arizona Association of Conservation Districts occupy a unique socio- political role in this decision making. The state enabling act for districts charges them to "provide for the restoration and conservation of lands and soil resources and the control and prevention of soil erosion and thereby to conserve natural resources . . . to protect and promote the public health, safety and general welfare of the people." With this directive and their supplemental memoranda of understanding with many federal agencies, the district supervisors can coordinate land use decisions and natural resource conservation.

The new Soil and Water Conservation District on the Navajo Indian Reservation opens even broader avenues of responsibility. The SCS was authorized to provide technical assistance to Indian land owners and users on tribal land in 1978. These two events expand district and SCS services to areas not previously served by district activities. This should provide even greater opportunities for leading the conservation efforts of the state.

SOIL CONSERVATION SERVICE

To provide assistance to Arizona's conservation districts, the Soil Conservation Service (SCS) has established area offices in Flagstaff and Tucson, 20 field offices, 10 soil survey offices, 5 resource conservation and development area offices, 2 watershed construction offices and the Wellton-Mohawk project office.

In addition to these offices, the SCS has individuals working with the Arizona Department of Water Resources and the Navajo Tribal Council under the intergovernmental personnel act.

RESOURCE CONSERVATION AND MANAGEMENT

Arizona's natural resources are diverse and intriguing. Many people are discovering that they provide an enjoyable place to live and our population is growing rapidly. As a result, increasing demands are made on the limited water supply, on the private lands, and on the public lands.

Arizona's Conservation District supervisors with help from the USDA, SCS provide assistance to land owners, land users and land use decision makers in meeting and solving the problems and opportunities created by these demands. New techniques coupled with dedicated efforts are bringing significant improvements in the wise use of our resources.

In 1978, Arizona's conservation districts held public meetings throughout the state to identify and prioritize the major resource concerns. This process was part of the public participation effort under the Soil and Water Resources Conservation Act of 1977. This report highlights the work carried on jointly by the conservation districts, their cooperators, and the SCS to solve the major problems identified at that time.

The Arizona Assocation of Conservation Districts published "A Program for Natural Resource Conservation Action" in February 1981. It details the nine resource concerns that most Arizonans felt were most critical. It contains recommendations of those actions which would best help to solve the problems.

The solutions identified required actions by individual land owners or users: by district supervisors; and by local, state or federal government agencies who are land use decision makers. The districts, through their unique role as implementers and coordinators, have a leading role in getting this work applied. To do this, each district identifies annually those priority concerns to which the supervisors will give emphasis and develops local programs to solve the problem. The state association assists the individual districts on those concerns which impact on larger areas than a district covers.

Because water is a critical resource, Arizona conservation leaders are focusing attention on managing its application, supply, quality and flooding. Benefits from this concern include increased food and fiber production, reduced soil erosion and improved recreation. The end result will allow adequate resource use to meet Arizona's and our Nation's needs.

FOOD AND FIBER PRODUCTION

Second in priority only to water management, the conservation of Arizona's food and fiber producing potential requires that, all of the items mentioned in this report be applied or addressed. If Arizona's resources are wasted now, no future effort can successfully restore them to their current level. The challenge to manage water and soil is a continuous one that is absolutely necessary to meet national and international food and fiber needs.

WATER MANAGEMENT

Arizonans use in excess of 4.8 million acre-feet of water each year. Approximately 52% of this comes from groundwater and the remainder from surface water diversions. The majority of the groundwater pumping exceeds the annual natural recharge.

The state's Groundwater Management Act of 1980 seeks to eliminate this overdraft by the year 2020 in the basins around Tucson, Phoenix and Prescott. The Act stipulates a reduced depletion rate in the Casa Grande-Eloy-Coolidge basin that will maintain the agricultural acreage.

Part of the solution will be accomplished through the importation of Colorado River water through the Central Arizona Project. The CAP is projected to supply 1.6 million acre-feet per year to the Phoenix, Casa Grande-Eloy-Coolidge and Tucson basins.

The rest of the solution is to wisely use the surface water and natural recharge currently being used. Arizona's agriculturists, as a major user of water, are taking actions through irrigation water management to conserve water supplies.

Water Application

Conservation districts and SCS have considered efficient water application as a high priority for nearly 40 years. Nearly 90% of the water used in our state is used to grow food, fiber and feed crops. As the result of irrigation and the ideal growing seasons, crop yields per acre rank among the highest in the nation. However, the current state-wide, on-farm average irrigation efficiency is only 54%.

Increasing energy costs and raidly dropping watertables are forcing farmers to place more emphasis on improving this efficiency. The SCS's basic conservation operations program as well as river basin studies, the small watershed program, the RC&D program, and the Wellton-Mohawk program all deal with this need.

New technologies such as laser leveling, automated systems and drip or trickle irrigation offer farmers the opportunity to control water more closely. But, SCS and farmer experience shows that with proper design and adequate management any type of irrigation system is capable of achieving 80% or more efficiency.

SCS conservationists have proven this in the last few years following decisions by NRCD's to place more emphasis on working with farmers on soil moisture monitoring and water application scheduling. Additional time has been spent with selected cooperators in several field offices on these activities. At the end of each crop season, it was found that many of these individuals had reduced water use by as much as 2 acre-feet on the higher water-consuming crops.

A more valid method of water management is to compute water use efficiency by comparing the amount of water applied in inches to the units of crop yield. Poorly managed and designed systems in Arizona's central valleys are using 35+ inches of water per bale of cotton. Well managed and designed systems use as little as 12 inches per bale.

During the 1981 season, a Coolidge farmer used trickle irrigation on a small acreage of cotton. At the end of the irrigation season, he had applied only 31 inches of water. His projected yield is at least 3 bales per acre and probably nearer 4 bales. He also noted that insect levels remained significantly lower and that weed growth was reduced. Because fertilizer could be applied through the system in small, controlled amounts, total use was less and plant response was almost immediate. His intentions are to minimum till and drill wheat onto this same acreage without removing the trickle tubes. Next year, if the yield is at least 3½ bales, plans call for installing trickle tubes on 100 acres.

In the Yuma area, we have been using a neutron probe for soil moisture monitoring. The sandy soils south of the city have traditionally been over-irrigated and have created some severe groundwater and salinity problems. Our work with the farmers has already resulted in decreased water use, improved crop yields, and reduced energy needs.

Near Safford, five landowners installed notched ditches to improve their water application methods. Farmers traditionally use siphon tubes in this area. High trash loads in the water diverted from the Gila River cause significant plugging and overtopping of ditches. The notches and the ditches allow passage of trash and permit better water control.

The Wellton-Mohawk Onfarm Irrigation Improvement Program, conducted under Title I of PL 93-320 in cooperation with the Bureau of Reclamation and other agencies, has been so successful that it has been extended to September 1986. This program was implemented to reduce the amount of saline groundwater being returned to the Colorado River. This is being accomplished by increasing irrigation efficiencies and preventing deep percolation of excess water. Based on comparisons between water use before and after system improvements, average efficiencies increased by about 30% and water use has been decreased by about 2 acre-feet/acre. These differences vary by crop from savings of 0.8 acre-feet on wheat to 5.36 acre-feet on citrus.

The original 5-year agreement was to treat 23,800 acres out of 65,000 in the Wellton-Mohawk Irrigation and Drainage District. It was completed in 1980. With the extension, it is planned to apply improved irrigation systems on much of the remaining acreage.

Urban conservation of applied water is also an important effort in which the SCS and NRCD's are involved. In Tucson, the Plant Materials Center has worked with city personnel to convert road medians to native plants. After several successful trial plantings, the city saw the opportunity to save significant amounts of water and have changed the landscaping on many old medians and now use low-water consuming plants on new medians.

In Phoenix, our conservationists are working with the Parks and Recreation Department. They are using the same principles of soil moisture monitoring and controlled water application to reduce water use on city parks.

Irrigation water management has been an important part of the land treatment program in all PL-566 Small Watershed Projects that include cropland. We have completed 5 projects protecting irrigated land and 4 others are in the construction stage. In the past, no additional monies were authorized for the purpose of improving irrigation efficiencies. However, with today's demands and new program direction, we are considering the possibility of using this program for land treatment in some selected areas.

The Santa Cruz-San Pedro, Little Colorado and Virgin River Basin Studies have all addressed Arizona problems and opportunities for irrigation improvements. Currently, we are working on a study for the Colorado River Indian Reservation in which water management is a primary purpose. The reports issued provide specific directions that local decision makers can use to plan programs for increasing irrigation efficiencies.

At the request of Arizona's Department of Water Resources and local farmers in the Pinal Active (groundwater) Management Area, we have requested authorization and funding to help meet the conservation objectives of the Arizona Groundwater Management Act for the Pinal groundwater basin.

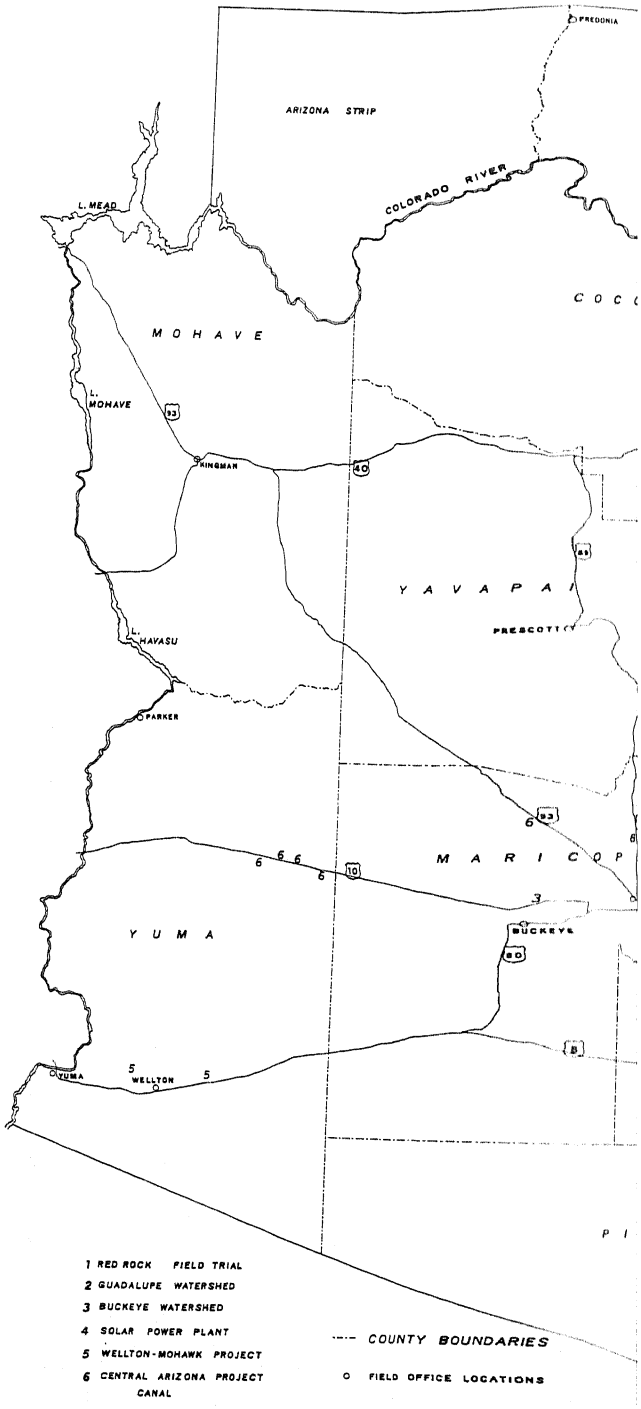
Soil surveys are an important tool in managing water application. In designing a system, the conservationist uses soil data available in these reports. In Arizona, we have completed and published surveys for several of the major farming areas and have field parties working on the other areas.

Water Supply

Arizonans use about 1.7 million acre-feet of the water that falls in the state or in the upper Gila Watershed in New Mexico each year. The remainder, by far the greatest proportion of this precipitation, either evaporates or is transpired by native vegetation. We also divert 0.9 million acre-feet from the Colorado River each year. In addition to managing what we presently use more efficiently, we need to consider every opportunity to increase the water supply.

As the population increases, more sewage effluent is generated and its treatment and reuse offer an important source of water. In both Tucson and Phoenix, treated effluent is used for irrigation or groundwater recharge. However, the acceptance and management of this resource is still in its infancy.

Recently, we assisted the Del Webb Corporation at Sun City West in planning to use the effluent from this new development for irrigation. An abandoned piece of farmland adjacent to Sun City, on the first terrace of the Aqua Fria River, was acquired. After secondary treatment, the treated water will be used to irrigate a golf course in the city and the cropland.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MARICOPA
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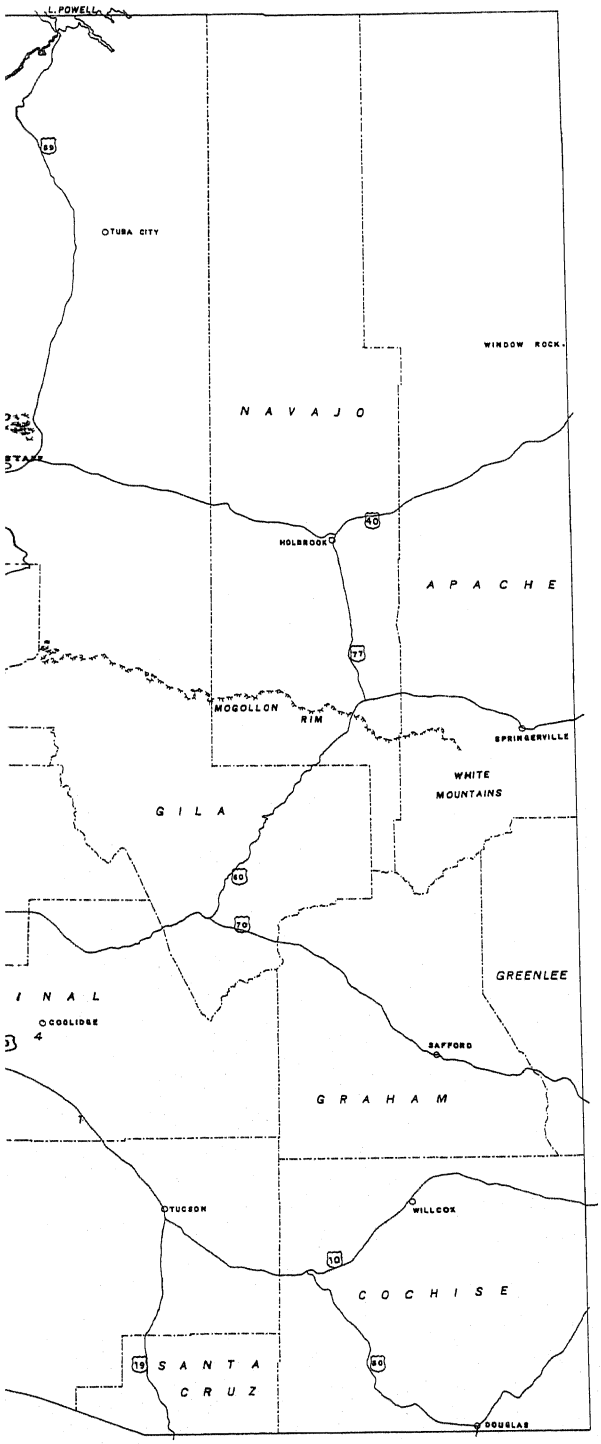
WELLTON
5
8
1 RED ROCK FIELD TRIAL
2 GUADALUPE WATERSHED
3 BUCKEYE WATERSHED
4 SOLAR POWER PLANT
5 WELLTON-MOHAWK PROJECT
6 CENTRAL ARIZONA PROJECT CANAL
COUNTY BOUNDARIES
FIELD OFFICE LOCATIONS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TUCSON
WILLCOX
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COCHISE
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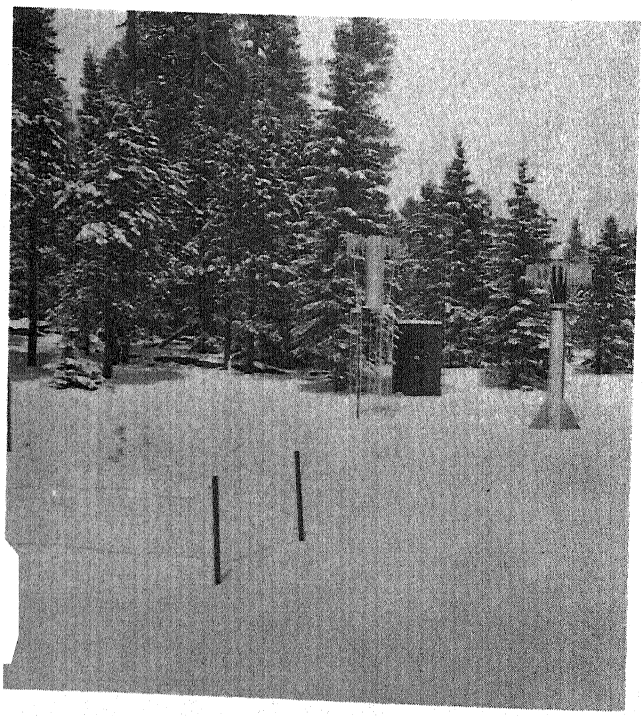
SANTA CRUZ
80
DOUGLAS

Some new reservoirs will be built to regulate the flow of CAP water. There are several other potential sites that could be developed for reservoir storage. Some of these are discussed in the river basin study reports for the Little Colorado and Santa Cruz-San Pedro. NRCD's in these areas feel that these potential reservoirs offer several opportunities in water management and as increased supplies of water.

One of the highest benefits in management of our water supplies comes from the snow survey and water supply forecasting program. The SCS has coordinated this effort in 11 western states since 1938. A network of 62 standard snow data sites and 19 'SNOTEL' sites allow us to accurately predict the amount of spring runoff in 8 major watersheds in Arizona. This forecast gives farmers, reservoir managers and flood control agencies the chance to prepare for the runoff well in advance.

Twice a month between January and April, snow surveyors visit the standard data sites and record snow depth and water content. This Information is updated by the computer-controlled, remote telemetry, 'SNOTEL' sites whenever we call for it. Using this data, the snow survey supervisor issues a status report of snow conditions and forecasts the expected runoff.

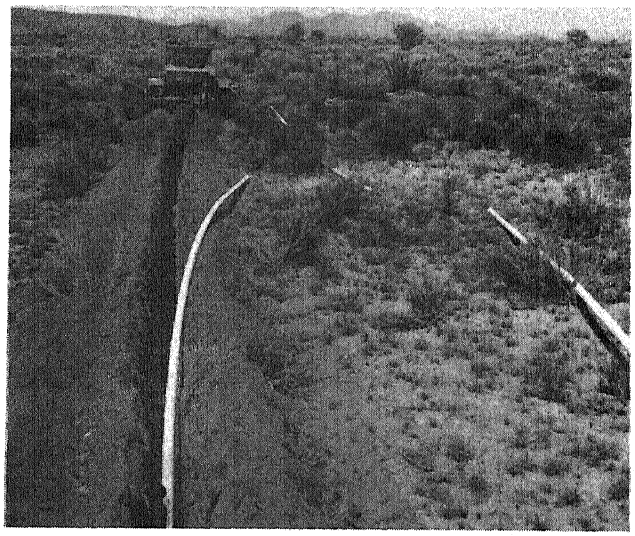
The 'SNOTEL' sites use solar energy to transmit computer messages by bounding signals off from meteor trails on a daily basis. This is a relatively new part of the snow survey program and the equipment is still being checked and correlated. It will eventually eliminate many of the manually read snow courses.



Range management also offers an effective tool in water supply management. A cooperator near San Manuel, northeast of Tucson, has applied a conservation program that improved most of his range to good or excellent condition. Although it has not been monitored, he and others have observed that streamflows from his land have been extended in time of flow and they are no longer sediment laden.

Because range and forest lands form the major watersheds of the state, land managers of these areas have a direct impact on our water supply. Good range practices result in improved range condition and increase water supply and quality. Forestry management also has a direct affect on water runoff and sedimentation and needs to be part of our state's watershed management program.

Ranchers are also interested in improving their water supplies. Pastures with poor water distribution usually have severe overgrazing around the water source and very light grazing away from water. As part of their grazing management, livestock operators in Arizona have invested considerable amounts of time and money on water developments. Recent trends have emphasized the installation of pipelines and water catchments rather than stockponds.



On the Arizona Strip, north of the Grand Canyon, a joint effort by the Agricultural Research Service, Bureau of Land Management, SCS and NRCD's has resulted in many water catchments being built. Because this area is short of permanent water, these artificial watersheds play a unique role in bringing water to underutilized areas.

Several RC&D projects installed or proposed jointly by local sponsors and the SCS have also been directed at improving the local rural and urban water supplies. The major projects included irrigation pipelines or canal lining. Seven of these installations will insure water supplies for 1,000 users irrigating more than 15,000 acres in small, rural areas of northern Arizona.

WATER QUALITY

The quality of groundwater in Arizona varies tremendously. Total dissolved solids, arsenic, sulfates, chlorides and fluorides are all problems in some areas. It is important for food and fiber producers to recognize these water quality problems.

In those few areas where pollutants are present, an awareness is essential to prevent plant, animal or human problems, Of more importance, however, is the impact of agricultural activity on the water quality. Where water application management is applied, this is of little concern. Where over-irrigation occurs, the deep percolation of surplus water carries various pollutants into the groundwater. This often leads to pumping for drainage purposes and adds appreciably to the salinity of surface waters.

The Wellton-Mohawk Project was established to address this specific problem. This project has been very successful in reducing deep percolation due to the application of excess water. Since 1975, improved irrigation systems have been installed on 21,620 acres.

The Virgin and Colorado River Indian Reservation River Basin studies also address the problem of increased salinity resulting from poor water management. This was the primary purpose for the Virgin River study which was completed in 1981. The report provides alternatives for reducing salt loading in the Virgin River, a tributary of the Colorado River.

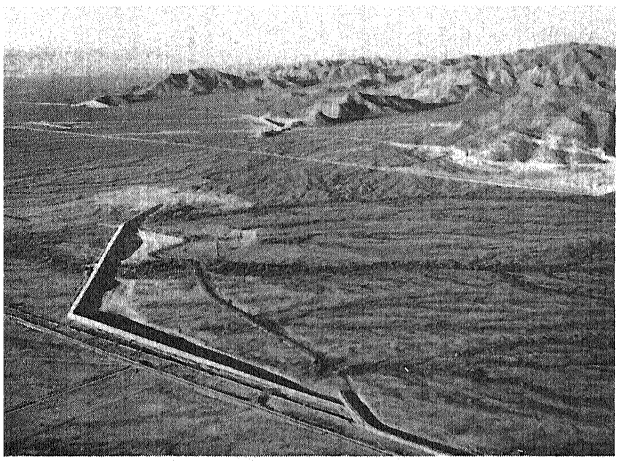
A soil sampling program is an important part of the Colorado River Indian Reservation study. The soil survey party collected about 375 soil samples and sent them to the National Soil Survey Laboratory in Lincoln, Nebraska. Each of the soils sampled had been irrigated from 2 to 10 years. The chemical analyses will help reconstruct the history of salt movement on these irrigated soils. The recommendations resulting from this analysis will be useful in reducing the salinity of return flows and groundwater in irrigated areas.

Land treatment, in addition to irrigation water management, is a major solution to protecting water quality. Most of the cropland in Arizona is leveled to non-erosive grades and, therefore, is not a primary source of sediment. In addition, most of the livestock feeding or dairy operations are designed so that effluent or washwater may be collected in ponds and used to irrigate adjacent cropland. Our major concern then is to apply range conservation practices, especially on critically eroding areas, to reduce soil erosion.

'LOODING

More than six million acres in Arizona are subject to periodic ooding according to the 1977 National Resources Inventory. The :verity and size of these floods varies tremendously. However, ıost Arizonans realize that, in addition to the damage caused, a ırge portion of the floodwater cannot be put to any beneficial use. 'ur desire to control or prevent this flooding is twofold; to prevent amage and to make beneficial use of the water.

Under the small watershed program, SCS has completed construcon on 10 projects. Another 5 projects are in the construction phase nd 4 are in the planning stage. Because of downstream water rights, one of these projects are allowed to store water for urban or irrigaon use. Of the 15 projects in construction or completed, 11 of these rotect prime farmland and adjacent communities. The other 4 pro:cts protect small rural communities with minimal amounts of ·opland. Emergency watershed protection projects in 27 locations ave been completed over the last four years. These projects have een installed for the purpose of restoring flooded areas to its reflood condition and to reduce the risk of loss of life and proper-



Through river basin and flood insurance studies, we have provid-d floodplain information to several communities or counties. If this ata is used by land use decision makers, future flood problems can e prevented in areas similar to those which have typically been eveloped in the past.

Good range conservation practices also aid in reducing flooding in mall watershed areas. Near Congress Junction, a rancher has intalled a waterspreading system and reseeded for the purpose of lood prevention and improved water use. This specially designed ield trial appears to offer a solution for both watersheds and ritically eroding areas.

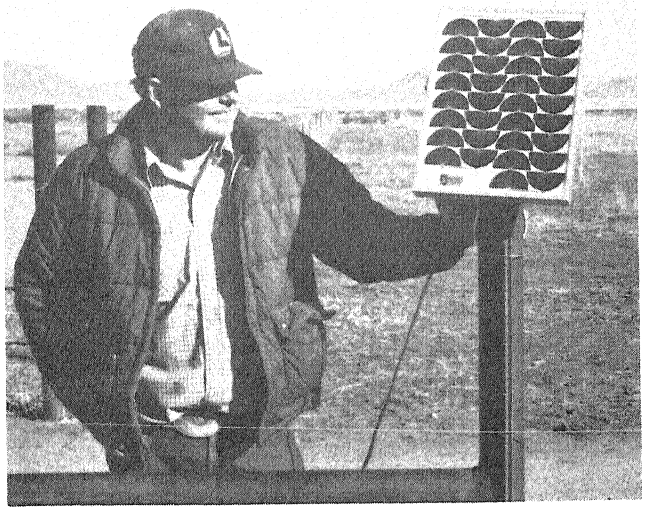
SOIL EROSION

Due to the low rainfall and level farmlands in much of Arizona, water erosion is limited and occurs primarily on range or forest lands. Wind erosion is a more severe problem that not only damages crops but has a significant impact on health and safety.

The National Resources Inventory begun in August 1980 will help delineate critically eroding areas within Arizona's major land resource areas. In addition, it will provide data on cropping history, land cover, soil potentials, wetlands and other basic resources. Arizona assigned several teams of soil scientists and conservationists to collect the field information. During 1981, they visited more than 1900 of the randomly selected primary sample units. After this inventory is completed, it will help SCS identify those areas that need increased attention to solve erosion and related resource problems.

The conservation districts and SCS have identified more than 16 million acres of rangeland needing treatment to improve the vegetative cover. Several conservation field trials have been conducted to treat these kinds of areas. These combine mechanical treatment with reseeding of adapted plants selected through our plant materials program.

A prime example near Red Rock along Interstate 10 was a joint effort by the Arizona Department of Transportation, Eloy NRCD, the SCS, and the cooperator. The location was selected because it was adjacent to an area in which major traffic accidents had occurred during dust storms. The results appear very promising and a second area has now been treated.



On larger areas of rangeland, the application of grazing systems and proper grazing use are proven practices that can help accomplish the conservation district's objective. During the last few years, a good deal of attention has turned to grazing systems referred to as "cell grazing" or "short duration-high intensity." Only a few of these management methods have been applied in Arizona.

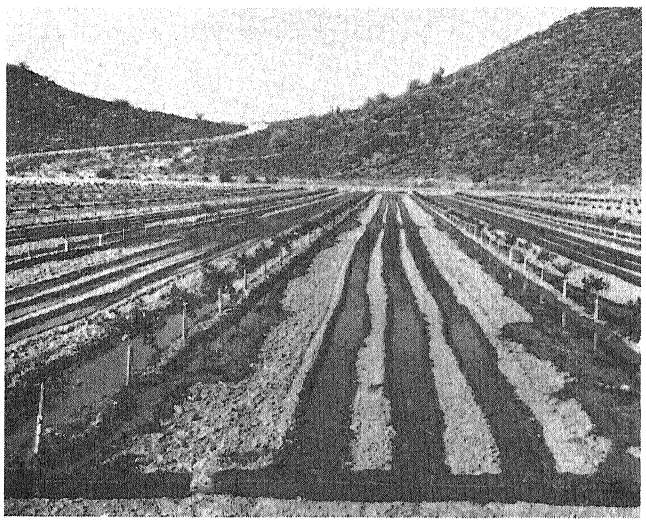
They are designed to increase the concentration of grazing animals on a relatively small acreage for very short grazing periods. By rotating through several similar size areas, repetitive use of desirable plants is reduced and plant vigor is enhanced.

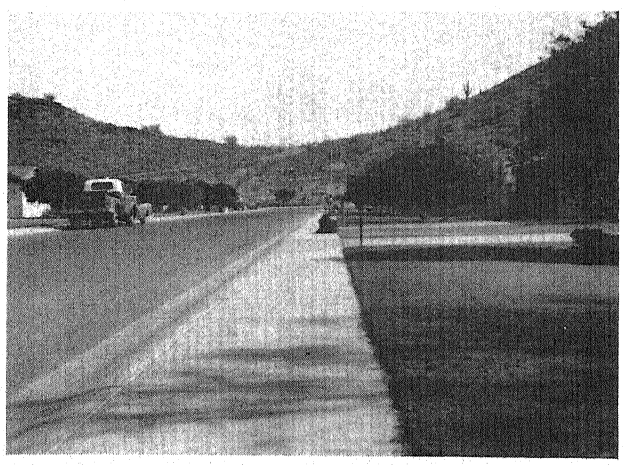
The soil survey program provides important resource data that will help in solving our soil erosion problems. Nine published soil surveys have been distributed on rangeland areas within Arizona. Another eight areas are currently being surveyed. Soil scientists map these areas and work with range conservationists to correlate their mapping units with range or woodland sites.

SCS also coordinates soil mapping among other agencies such as the Forest Service, Bureau of Land Management, Bureau of Indian Affairs and Arizona Agricultural Experiment Station. We are providing three survey parties to make soil surveys on land administered by the BLM and also have a crew surveying the Hopi Indian Reservation. This surveying is being done through reimbursable funding.

LAND USE

Land use decisions in Arizona are influenced by many factors. Because of the land ownership and nationally important resources produced or found here, we find that there is considerable national interest and impact on our decisions. Federal land use policies reflect trends and directions that are strongly responsive to demands made in the population centers of the country and not of local residents. Food or fiber production demands are created not only by national but by international needs. The rapid population growth brings many newcomers to the state. These people make many of their decisions based on experiences they had elsewhere and not on the conditions found here.





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Of primary interest to SCS and conservation districts are those decisions concerning and affecting our soil, water and related natural resources. Prime farmland retention, floodplain management, water conservation, water quality and soil erosion are primary concerns that have been identified. Our efforts in making others aware of these needs have been mentioned earlier. However, some of these bear repeating because of their potential impact on land use decisions being made daily by land owners, land users and land use decision makers at state, county and local levels.

The soil survey program provides critical data necessary for both land use and water management decisions. As requested, we prepare interpretive maps or make on-site investigations about the soil showing its prime or unique farmland status or its limitations for an intended use. The availability and use of this information needs to be expanded.

Our river basin studies are generally a cooperative effort between federal, state and local agencies. When a report is completed, it receives wide distribution to potential users. In the case of the Santa Cruz-San Pedro reports, their usefulness exceeded our prediction and we had to reprint the material because of the many requests for copies received. About 650 copies of the reports have been distributed.

The snow survey reports published between January and April each year are mailed to more than 500 individuals, organizations and units of government in both Arizona and New Mexico. They are an important tool in water management and each addressee is on this list because they requested the information.

Watershed plans prepared for each of the small watershed projects in Arizona contain data about land use and land treatment. Local sponsors are encouraged to consider this information in selecting solutions to their flooding problems. Local community land use or land treatment decisions can also be made from this data.

RECREATION

Arizonans spend millions of days in recreation activities each year. Water-based recreation spots are heavily favored and Arizonans have as many boats per capita as almost any state in the nation.

The SCS does provide planning and environmental education assistance to many of the youth and religious organizations who operate camps in Arizona. Most of these camps are located on private land within our national forests and, frequently, have limited soil and water resources. Therefore, good conservation planning and application is an important task.

One of the primary objectives of both the Colorado River Indian Reservation and Little Colorado River Basin Studies was to identify recreation/fish and wildlife potentials. The final reports will deal with both the problems and opportunities for developing these resources.